A LIMNOLOGICAL SURVEY OF LAKES ON THE LEVEED FLOOD-PLAIN OF THE MISSISSIPPI RIVER IN WESTERN ILLINOIS

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Five lakes on the leveed floodplain of the Mississippi River near Quincy, Illinois, were selected for a three-year study of seasonal and annual variations of the bottom fauna and plankton in relation to the biological and physico-chemical factors. Collections were made approximately monthly.

The lakes are small, ranging from 23.5 to 63.3 acres in area. They are oxbow lakes, occupying parts of an old stream channel, and are very shallow, with saucer-shaped bottoms. There are no submerged or floating aquatic plants.

The highest water temperatures of 30-40°C. usually occurred in June or July. Ice formed during the winter, but because of the frequent warm spells the ice was often thin, and melted occasionally during the winter.

Carbon dioxide highs occurred in winter, in some cases being more than 25 ppm. However, free carbon dioxide was usually low, ordinarily being under 10 ppm. Total alkalinity usually was above 100, and in the winter was as high as 250 ppm. In one lake, total alkalinity averaged about 100 ppm. In this lake, carbonate exceeded 25 ppm during one summer. Another lake frequently contained 10 ppm. carbonate or more. Ordinarily, however, carbonate was under five ppm. The range of pH was from a minimum of 6.7 to a maximum of +10.0. Usually the range was about 7.2 to 8.4 or 8.6. Lowest points occurred in winter, and highest points in summer.

Dissolved oxygen was high in the winter, except in 1950-51,

when ice covered the lakes for an unusually long time. Occasional peaks in oxygen concentration were observed in the warmer months.

Turbidity was usually high except at times when ice covered the water. Color was negatively correlated with turbidity, although peaks and depressions in the two factors frequently coincided.

The bottom fauna was restricted in numbers of species. The principal forms encountered were **Chaoborus punctipennis,** two species of **Procladius,** two species of **Pelopia, Coelotanypus concinnus,** several tendipedids, a heleid, and one species of **Peloscolex. Physella sayii crassa, Helisoma trivolvis, Helisoma antrosa percarinata,** and **Viviparus intertextus illinoisensis,** common in shallow water, and a few **Anodonta grandis footiana** and **Anodonta corpulenta** were the only molluscs present in any numbers. Materials dredged from the bottom in the construction of a dam showed that a population of at least eight species of pelecypods and four species of gastropods formerly existed in the lakes. Studies of life histories, chiefly on the basis of length-frequencies and seasonal abundance, showed that **Coelotanypus concinnus** has a two-year life cycle, **Chaoborus punctipennis** has a one-year cycle, and **Pelopia** sp. may have a two-year cycle.

The effect of a number of catastrophic events on bottom organisms and fishes was observed. A summer thunderstorm, with flooding of one lake, was followed by a reduction of dissolved oxygen concentration. Bottom fauna, with the exception of tubificid worms, was virtually eliminated. A prolonged ice cover of over ninety days in one winter resulted in no great reduction of bottom populations, although **Chaoborus punctipennis** larvae were found floating dead in the water after the ice melted. Studies following partial drying of one lake indicated that the surviving populations may partially repopulate the denuded area when water levels rise again.

Dredging was found to result in a larger population of insect larvae in comparison to the population of tubificid worms in the dredged area, but approximately equal total weights of organisms in the dredged and undredged areas.

Heavy fish mortality was observed following the winter of prolonged ice cover. The summer reduction of oxygen following the flood at one lake resulted in a great mortality of Buffalo, so that altogether apparently most of the fish were eliminated. Bottom fauna production was greatly increased in this lake. Fish predation is indicated as an important factor in holding bottom populations at a relatively low level.

The available data indicate that total weights and numbers of organisms is approximately the same over most of the bottom of the open water, with little variation in the distribution of individual species. Transects from the shore indicate a progressive increase of total weights and numbers of organisms from the shore toward the center in the first few meters, with a considerable variation in the distribution of individual species.

The net plankton is composed of a rather large number of species of zooplankters and phytoplankters. Protozoa are sparsely represented. The Rotifera are represented by at least 34 species, in which the genus **Brachionus** is prominent, with nine species. Ten species of Copepods are present. The Cladocera are represented by six species. No marked seasonal morphological variations were observed in either the Rotifera or the Cladocera.

The blue-green algae were represented by 11 species, with occasional great maximum populations. The green algae, with at least 29 species, and the Euglenophytes, with at least 11 species, were important groups. Desmids were very scarce. Diatoms were not numerous, however, occasional pulses of large size were noted. Maximum populations, or pulses, of the different major net plankton groups were highly irregular and differed from year to year in size and seasonal occurrence in each lake. Total

net phytoplankton and zooplankton in one lake were found to have a negative coefficient correlation of .408 when compared on the same collecting dates.

These five lakes were found to have many characteristics of plankton populations common to ponds. This fact, together with their small size, indicates a position on the borderline between true lakes and ponds.

Collections of fishes were made by seining in these lakes, in the open sloughs outside the levee, and in the open river. These collections were compared with those of other authors extending back to 1888. The date indicate the elimination of a number of species, and a great reduction or elimination of the young of several species, indicating that the various drainage and other land and water improvement projects have had a detrimental effect on the populations of fishes.

These lakes represent successional stages in the series from climax stream communities to terrestrial communities. The successional process is initiated by the stoppage of current in the original stream. The sedimentation and filling processes which normally aid the continuation of the succession are largely inoperative in this location. Wave action on the shallow bottom, and the activities of bottom-feeding fishes have maintained a partial climax condition and the lakes are at present in a condition of successional stasis.

VITA

Troy Clyde Dorris was born April 6, 1918, in Franklin County, Illinois. He graduated from West Frankfort Community High School in 1936. He received the degree of Bachelor of Education in 1946, and the degree of Master of Science in Education in 1947, from Southern Illinois University at Carbondale. He has studied at the University of Iowa, the University of Michigan Biological Station, Duke University Marine Laboratory, and the University of Minnesota Biological Station. He entered the Graduate College of the University of Illinois in 1951. He held a University Fellowship in the academic year 1951-1952, and again in 1952-53.